Measles

Report Immediately

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Measles is caused by measles virus (genus *Morbillivirus*, family *Paramyxoviridae*).

B. Clinical Description

Measles is an acute disease characterized by fever, cough, runny nose, conjunctivitis, and maculopapular rash. Complications include diarrhea, otitis media, pneumonia, encephalitis (1 per 1,000 cases), and death (1–3 per 1,000 cases, mostly from pneumonia and occasionally from encephalitis). Immunocompromised individuals are at increased risk for pneumonitis, encephalitis, and death. These complications can occur in 20–80% of HIV-infected and oncology patients. The characteristic rash sometimes does not develop in these patients. Asymptomatic carriage has not been documented.

C. Reservoirs

Humans are the only host.

D. Modes of Transmission

Measles is transmitted person-to-person by droplet or direct contact with nasopharyngeal secretions of an infected person, and by the airborne route.

E. Incubation Period

The incubation period is usually 8–14 days, with a range of 7–18 days.

F. Period of Communicability or Infectious Period

From 4 days before to 4 days after rash onset (counting the day of rash onset as day zero). Immunocompromised patients may have prolonged excretion of virus in their secretions and can be infectious for the duration of their illness. Measles is highly infectious, with up to 5,000 infectious particles excreted per hour. Infectious particles may remain suspended in air for up to 2 hours, depending on ventilation, sunlight exposure, and relative humidity.

G. Epidemiology

Measles occurs worldwide. In the temperate zones, peak incidence is in late winter and early spring. One dose of MMR vaccine induces measles immunity in about 95% of vaccinees; however, due to measles' extreme infectiousness, two doses are necessary to prevent outbreaks. Vaccine failure after 2 doses, both administered at $\geq$ 12 months of age, is now uncommon.

In developing countries, case fatality rates average 3–5% but can range as high as 10–30% in some localities, and measles is the eighth leading cause of death worldwide. Since 1995, incidence of measles in the United States has been very low, with only a few hundred cases reported each year, and indigenous transmission has been interrupted. An increasing proportion of US cases are imported, often from Europe and Asia. (Cases are considered imported from another country if the rash occurs within 18 days of entering the US and the illness cannot be linked to local transmission.)

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

- A case of rash illness accompanied by fever, or
- A suspect case of measles (with or without fever), as diagnosed by a healthcare provider, or
- Positive serologic test for measles IgM, or
- Significant rise between acute- and convalescent-phase titers in serum measles IgG, *or* total antibody level by any standard serologic assay, or
- Isolation of measles virus from a clinical specimen.

Note: See Section 3) C below for information on how to report a case.

B. Laboratory Testing Services Available

1. **Serologic Testing**
   - **Measles IgM test—**MDPH strongly recommends submission of specimens to the Massachusetts State Laboratory Institute (SLI). Ideally, the specimen should be drawn at least 3 days after onset of rash to minimize the possibility of false negative results. If serum is collected prior to the third day, a follow-up specimen may be requested.
   - **Measles total antibody paired-titer test—**The measles IgM test above is greatly preferred because it provides an earlier result. However, the SLI also performs this paired-titer test. Acute serum should be collected as soon as possible after onset of rash; convalescent serum should be collected about 14 days later.
   - **Shipment of sera—**Please refer to Attachment A (at the end of this chapter) for instructions on collecting and submitting specimens to SLI. At least 2 ml. of serum should be sent on a cold pack, with a completed virus serology requisition form (in Attachment A), to: Virus Serology Laboratory, State Laboratory Institute, 305 South Street, Jamaica Plain, MA 02130. Before sending, please call an immunization epidemiologist at (617) 983-6800.

2. **Virus Isolation/Molecular Characterization of Measles—**Virus isolation is much less useful for disease control purposes than serologic testing because results are not available for several weeks. However, molecular characterization of isolated measles virus is an extremely important tool in epidemiologic investigation; for example, to determine source of the infection and which cases and outbreaks are linked to each other. Also, in cases where serology is not useful or possible (for example, when a suspect case has been recently vaccinated with MMR), virus isolation can be used for confirmation, and molecular characterization can distinguish wild-type virus from vaccine virus. Specimens submitted to the SLI for measles virus isolation will be forwarded to CDC.

   The table below and Attachment A (at the end of this chapter) show how to collect specimens.

Measles Viral Isolation

Specimen	Collection Interval
Urine[1]	≤5 days after rash onset
Nasopharyngeal[2]	≤5 days after rash onset
Blood[3]	≤7 days after rash onset

[1] Clean voided first morning urine
[2] Separate swab for nares and pharynx
[3] Blood in green top tube (heparinized)

Please contact an Immunization Epidemiologist at (617) 983-6800, who will arrange for virus specimens, if needed. See Attachment A (end of chapter) for the current protocol for collection and submission.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify all cases and susceptible exposed people rapidly and to prevent further spread of this highly contagious disease.
- To identify the source of infection so as to better understand how and why the case(s) occurred.
- To help in the international effort to eliminate indigenous transmission of measles from the Western Hemisphere.

B. Laboratory and Healthcare Provider Reporting Requirements

Refer to the list of reportable diseases (at the end of this manual's introductory section) for information.

Note: Due to the potential severity of measles, the Massachusetts Department of Public Health (MDPH) requests that information about any case be **immediately reported** to the local board of health where diagnosed. If this is not possible, call the MDPH Division of Epidemiology and Immunization, Surveillance Program at (617) 983-6800 (weekdays) or (617) 522-3700 (nights/weekends).

C. Local Board of Health Reporting and Follow-up Responsibilities

MDPH regulations (*105 CMR 300.100*) stipulate that each local board of health (LBOH) must report the occurrence of any case of measles (as defined by the reporting criteria in Section 2A). Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

Note: The MDPH requests that information about any suspect or known case of measles be **immediately reported** to the MDPH Division of Epidemiology and Immunization, Surveillance Program by calling (617) 983-6800 (weekdays) or (617) 983-6200 (emergency number for nights/weekends).

Note: Due to national surveillance and reporting requirements, the Massachusetts Immunization Program (MIP) takes the lead on measles case investigation (including filling out the case report form) and disease control recommendations, in collaboration with the local board of health. MIP will keep the local board of health informed of all significant developments and will request the assistance of the board of health as needed.

D. Initial Questions to Ask Healthcare Provider and Patient

In order to assess the likelihood that a suspect case is a true case prior to laboratory testing, MIP and/or other public health staff helping in the investigation should ask about: 1) symptoms, 2) measles immunization history, 3) country of origin and length of residence in US, 4) recent history of travel (to where and dates), 5) whether there were any recent out-of-town visitors (from where and dates), and 6) whether there was any recent contact with anyone with similar symptoms.

4) CONTROLLING FURTHER SPREAD

This section provides detailed control guidelines that are an integral part of case investigation. Local boards of health should familiarize themselves with the information. However, the Massachusetts Immunization Program will take the lead on implementing control measures, in collaboration with the board of health.

A. Isolation and Quarantine Requirements (*105 CMR 300.200*)

The Isolation and Quarantine Requirements (promulgated November 1998, printed July 1999) are out of date with respect to measles. Current recommendations of CDC and MDPH (as of 2000) are as follows:

Minimum Period of Isolation of Patient

Through 4 days after onset of rash (counting the day of rash onset as day zero).

Minimum Period of Quarantine of Contacts

Students and staff born in or after 1957, who are not appropriately immunized and do not have serologic evidence of immunity, will be excluded from school from the 5th through the 21st day after their exposure. If exposure was continuous and/or if multiple cases occur, susceptibles will be excluded through the 21st day after rash onset in the last case. **Healthcare workers** who are not appropriately immunized and do not have serologic evidence of immunity will be excluded from work from the 5th day after their first exposure through the 21st day after their last exposure. These restrictions for students, school staff, and healthcare workers remain even if the contact received IG.

B. Protection of Contacts of a Case

1. Implement control measures *before* serologic confirmation.

2. Inquire about contact with a known or suspected case or travel during the measles exposure period (8–18 days prior to onset).

3. Isolate the case during his/her infectious period, as defined above.

4. Identify all those exposed. Think in terms of the "zones of exposure" and consider members of the following groups, if they were in contact with the case during his/her infectious period.
   - household members
   - school/daycare contacts (students and staff)
   - staff and patients at medical facility where patient was seen (including staff with and without direct patient contact)
   - individuals at workplace of case (especially daycare centers, schools, and medical settings)
   - members of same religious/social groups
   - members of sports teams, other extracurricular groups
   - bus or carpool mates
   - close friends
   - persons potentially exposed at social events, travel sites, etc.

   Note: Measles is so contagious that we often consider everyone at an *entire* institution exposed.

5. Identify high-risk susceptibles with whom the case had contact during his/her infectious period. Pregnant women, immunocompromised individuals, and infants < 12 months of age should be referred to their healthcare provider.

6. Identify all other susceptibles, that is, individuals *without* proof of immunity as defined below:
   - born in the United States before January 1, 1957 (year of birth as proof of immunity does not apply in health care settings, see Section 4) C. 2 [starting on page 8] for additional recommendations in healthcare settings); or
   - two doses of measles vaccine, given at least 4 weeks apart, with both doses administered at ≥12 months of age; or
   - serologic proof of immunity.

   Note:
   - Foreign-born individuals must have documentation of immunization or serologic proof of immunity. "Born before 1957" is not acceptable (see below for explanation).
   - Physician-diagnosed disease is **NOT** acceptable.
   - Susceptibles include those with medical and religious exemptions to immunization.

   Year of Birth as Proof of Immunity—Epidemiologic data indicate that most individuals born in the United States before January 1, 1957 are immune to measles. This has not been found to apply to those born in other

countries, where the epidemiology of measles is not well known and where measles immunization may not have been routine.

Exceptions to the "1957 Rule" are employees in healthcare settings. Because persons born before 1957 have acquired measles in healthcare settings, vaccination of these older employees, including those who are United States-born, with 1 dose of measles, mumps, rubella (MMR) vaccine is recommended. Please refer to Section 4) C. 2 (page 8) for more information about management in healthcare settings.

7. Immunize all susceptibles. Please review Attachment B on "Recommendations for Measles Immunization" and Attachment C on "MMR Vaccine Concerns" located at the end of this chapter. All susceptibles ≥12 months of age, for whom vaccine is not contraindicated, must be immunized, keeping in mind the following:

   - **MEASLES VACCINE GIVEN WITHIN 72 HOURS OF EXPOSURE CAN PREVENT DISEASE.**
   - The combined MMR vaccine is the preferred formulation for all those ≥12 months of age. It will provide additional protection against mumps and rubella.
   - Vaccinating an individual who may be incubating measles is **NOT** harmful.
   - Vaccinate susceptibles even if it is >72 hours postexposure. It will protect against exposure to the next potential generation of cases. In addition, the situation should be viewed as an opportunity to vaccinate.
   - MMR vaccine should never be given to infants <12 months of age. In addition, monovalent measles vaccine is not routinely given to this age group, unless indicated by local epidemiology.

8. Consider recommending immune globulin (IG) for susceptibles with contraindications to measles vaccine if it is within 6 days of exposure. See Attachment D (at the end of this chapter) for a list of such individuals, the recommended dosages, and subsequent deferral of live viral vaccines.

9. Isolation/exclusion (non-healthcare settings):
   a. **Case**
   Isolate and exclude the case during his/her infectious period (from 4 days before through 4 days after rash onset, counting the day of rash onset as day zero). He/she may return to normal activities on the 5th day.

   Criteria for isolation/exclusion of case are more rigorous for immunocompromised individuals and for others in healthcare settings, as outlined below in Sections 4) C. 2 and 4) C. 3 found on pages 8-11.

   b. **Contacts**
   - Susceptibles include all unvaccinated individuals without proof of immunity as specified in section 5 above, including:
     - individuals who receive IG
     - medical/religious exemptions
     - individuals who have other contraindications to MMR vaccine
     - those vaccinated >72 hours postexposure.
   - Isolate susceptibles on days 5–21 postexposure.
   - Several criteria are used to determine when to exclude susceptible contacts, and when they can return to normal activities, as outlined below.
     - **If there was a discrete (one-time) exposure—**exclude on days 5 through 21 from that exposure. They may return to normal activities on the 22nd day.
     - **If there was continuous exposure**—exclude on days 5 through 21 from the day of rash onset in the case. (However, in healthcare settings, exclusion must begin 5 days after the *earliest* exposure and

extend through 21 days from the *last* exposure.) They may return to normal activities on the 22nd day.

- **If there is more than one case of measles**—susceptibles will need to be excluded until 21 days after the onset of rash in the last reported case in the outbreak setting. They may return to normal activities on the 22nd day.

Summary of Measles Exclusion Requirements

Case and Symptomatic Contacts	Asymptomatic Contacts
Exclude through the 4th day after rash onset (count day of rash onset as day zero). They may return to normal activities on the 5th day.	**One case:** Exclude susceptibles for 5–21 days post-exposure. **Multiple cases:** Exclude susceptibles for 21 days from date of rash onset in last case. **Health care settings:** Exclude or isolate susceptibles from 5 days after the earliest exposure through 21 days after the last exposure.

(Please refer to Section 4) C. 2 [starting on page 8] for more complete isolation/exclusion recommendations for cases and contacts in healthcare settings.)

10. Conduct surveillance for 2 incubation periods (28 days) after rash onset in the last case or the last exposure in the setting, whichever is later.

C. Managing Special Situations

1. **School Settings**

Remember to determine if there are any:

- Pregnant teachers, staff (including those without direct contact with students) and students (do not forget about student teachers) anywhere in the school.
- Immunocompromised individuals among the students, teachers and staff anywhere in the school.
- Medical/religious exemptions anywhere in the school, among both students and staff. It is particularly important to identify these individuals in the classroom and grade of cases. Remember, these susceptible individuals must be excluded.

Exclusion criteria:

- Susceptible contacts, including those in classrooms, extracurricular activities, and other settings, who have already received one dose of MMR and receive a second dose of measles vaccine within 72 hours of exposure can be readily readmitted; otherwise, they should be excluded as discussed above.

- In some settings, individuals who have received their first or second dose >72 hours postexposure, **but within a specified time period (as determined by the Massachusetts Immunization Program with the local board of health)**, may be allowed to continue to attend classes.

If multiple cases occur, guidelines may be revised to include other classrooms and their teachers.

Interactions in sports and other extracurricular activities facilitate the spread of measles. Additional recommendations to prevent the spread of measles between schools can be found in the table below, "Control Guidelines for Sports Teams and Extracurricular Groups."

Massachusetts Department of Public Health
Immunization Program

Control Guidelines for Sports Teams and Extracurricular Groups

Control guidelines DIFFER and are dependent on whether measles is currently occurring at your institution. Schools without cases, but that will be involved with an institution that is experiencing cases, also need to follow control guidelines. Please refer to the appropriate category below for the recommendations for your facility.

A. **At the School where Measles Cases Are Reported:**

1. All students, staff, supporters and media personnel leaving to attend activities at other schools or participating in sports or other group activities at your school must have proof of immunity as defined below:

   - Born in the United States before January 1, 1957, or
   - Two doses of measles vaccine with both doses administered at ≥12 months of age, given at least 4 weeks apart (the second dose must have been given before the rash onset of the first case, or within 72 hours of exposure to the known case), or
   - Serologic proof of immunity

   Note: Physician-diagnosed disease is **NOT** acceptable

   If the second dose of measles-containing vaccine is given >72 hours after the onset of the first case, the student **must wait 21 days** before participating in sporting events or traveling to another school. If multiple cases occur, the student must wait until 21 days after the onset of rash in the last reported case in the outbreak setting.

2. Notify the schools to which students are traveling and inform them of:

   - the cases or suspected cases at your school
   - the immune status of your students and staff who will be traveling to the other school

B. **Schools without Measles Cases Receiving Students from or Traveling to a School with Measles Cases:**

All students, staff, supporters and media personnel, participating in activities with students from a school with cases, must have proof of immunity as defined below.

- Born in the United States before January 1, 1957, or
- Two doses of measles vaccine with both doses administered at ≥12 months of age, given at least 4 weeks apart (as outlined above), or
- Serologic proof of immunity

Note: Physician-diagnosed disease is **NOT** acceptable

2. **Healthcare Settings**

Recommendations for healthcare facilities are *more rigorous.*

a. **Proof of immunity—**The risk of acquiring measles in medical settings is up to 13-fold higher than in other settings. Therefore, documentation of immunity is extremely important.
   - All staff born on or after January 1, 1957 should have proof of two doses of measles vaccine or serologic proof of immunity, with a second dose having been given ≤72 hours after exposure.
   - Medical personnel born before January 1, 1957 have acquired measles in medical facilities. Therefore, strong consideration should be given to requiring at least one dose of measles vaccine for staff born before 1957.
   - In special high-risk health care settings such as transplant, oncology, neonatal units, etc., exclusion criteria should be even more rigorous. Infection control personnel may wish to exclude all susceptible personnel even if they have been immunized within 72 hours.

b. **Initial management of patients with febrile rash illness—**Assess and screen all patients with febrile rash illness, either prior to or immediately on arrival at the intake area.
   - Escort patients to a separate waiting area or place immediately in a private room.
   - Both patients and staff should wear appropriate masks/respirators (masks for patients to prevent generation of particles, and respirators for staff, if possible, to filter airborne particles).
   - If not admitted, maintain airborne precautions (including while patient is exiting the facility, *e.g.*, separate exit). Patients should receive instructions to remain in isolation at home, through 4 days after rash onset.
   - Measles virus can remain suspended in the air for up to 2 hours. Therefore, we recommend that susceptible patients **NOT** be placed in a room which has been occupied by a suspect case for 2 hours following the case's exit from that room.

c. **Infectious period**
   - **Cases** are considered to be infectious from **4 days** before rash onset through 4 days after rash onset, counting the day of rash onset as day zero. Therefore, cases are considered infectious for a total of 9 days.
   - **Immunocompromised patients** may have prolonged excretion of viral particles in their secretions, and should be considered infectious for the duration of their illness.

d. **Exclusion/isolation of cases**
   - **Personnel** who become sick should be excluded from work for 4 days after they develop a rash consistent with measles. They may return on the 5th day.
   - If **admitted**, **patients** should be on airborne precautions (in addition to standard precautions) while infectious (4 days before rash onset through 4 days after rash onset) in a negative pressure room. They may be taken off isolation on the 5th day.
   - If **not admitted, patients** should maintain respiratory isolation while exiting the facility, *e.g.*, mask, separate exit, and remain at home through 4 days after rash onset. They may return to normal activities on the 5th day.

e. **Exclusion/isolation of contacts—**The exclusion/isolation periods are extended in the healthcare setting.
   - **Susceptible staff contacts** should be excluded from the 5th day after the earliest exposure through the 21st day after the last exposure to the case during his/her potential infectious period (as defined above). They may return on the 22nd day.
   - **Susceptible patient contacts** should be placed in airborne isolation from day 5 after the earliest exposure through day 21 after the last exposure to the case during his/her potential infectious period (as defined above). They may be taken off isolation on the 22nd day.

The above recommendations are summarized in the table below, "Measles Control in Medical Settings."

Massachusetts Department of Public Health
Immunization Program

Measles Control in Medical Settings

This table summarizes additional control measures to decrease nosocomial measles transmission.

1. Assess and screen all patients with rash illness or with other potential airborne diseases, either prior to or immediately on arrival at intake area.
2. Escort patients to a separate waiting area or private room.
3. Both patients and staff should wear appropriate masks/respirators (masks for patients to prevent generation of particles, and respirators for staff, if possible, to filter airborne particles).
4. If admitted: maintain on airborne precautions (in addition to standard precautions) while infectious in a negative pressure room. (Patients are considered infectious for 4 days before through 4 days after rash onset, counting the day of rash onset as day zero.)
5. If not admitted: maintain respiratory isolation, including while patient is exiting the facility, (*e.g.*, mask, separate exit). Patient should remain in isolation at home through 4 days after rash onset, counting the day of rash onset as day zero. The patient may resume normal activities on the 5th day.
6. Avoid placing susceptibles in a room which has been occupied by a suspect case for 2 hours following the case's exit.
7. Identify all contacts among patients and staff:
   - this includes patients and families in the waiting and examination rooms up to 2 hours after index case was present;
   - includes all staff both with and without direct patient contact;
   - due to airborne route of transmission, those exposed often include everyone at the entire facility.
8. Identify susceptibles (particularly high-risk susceptibles) and offer:
   - MMR within 72 hours of exposure (will most likely prevent illness if given in this window), or
   - for high-risk susceptibles and those ineligible for vaccination, IG $\leq$6 days after exposure (may modify or prevent illness, but a recipient can still be considered infectious)
9. Notify infection control, employee health, department heads and the healthcare providers of exposed patients.
   - Put up "Measles Alert." (This may be obtained from your immunization epidemiologist.)
10. Exclusion of susceptibles:
    - All staff born in or after 1957, who have not received a second dose of measles vaccine $\leq$72 hours post exposure, must be **excluded from 5 days after their earliest exposure through 21 days after their last exposure to the case during his/her potential infectious period.**
    - All staff born before 1957 who have not received 1 dose of MMR $\leq$72 hours post exposure must be excluded 5–21 days post exposure.
    - Staff who contract measles should be excluded for 4 days after their first day of rash onset.

    In special high-risk healthcare settings such as transplant, oncology, neonatal units, etc., exclusion criteria should be even more rigorous. Infection control personnel may wish to exclude all susceptible personnel even if they have been immunized within 72 hours.

3. **Management and MMR Vaccination of HIV-Infected Individuals and their Contacts**

The American Academy of Pediatrics (AAP) and the Advisory Committee on Immunization Practices (ACIP) have recently revised their recommendations regarding the management of HIV-infected individuals exposed to measles, as well as the routine MMR immunization of those with HIV infection, particularly those with severe immunosuppression. These guidelines, applicable to children and adults, are summarized below.

a. **Management of HIV-Infected Individuals Exposed to Measles**

1) MMR or IG should be given, depending on the situation:

- **Asymptomatic HIV-infected individuals who are not severely immunosuppressed** (*i.e.,* with higher age-specific CD4+ T-lymphocyte counts or percentages than those in the table on the next page), *if susceptible and exposed ≤ 3 days prior* should receive MMR vaccine.

- **Asymptomatic HIV-infected individuals who are not severely immunosuppressed** (*i.e.,* with higher age-specific CD4+ T-lymphocyte counts or percentages than those in the table on the next page), *if susceptible and exposed 3–6 days prior* should receive *0.25cc/kg IM* immune globulin (maximum 15cc). They should subsequently be immunized with MMR after the appropriate interval. Please refer to the table in Attachment D: "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."

- **Symptomatic HIV-infected individuals who are severely immunosuppressed** (as defined in the table on the next page), *regardless of past history of immunizations or disease, unless they have recent serologic proof of immunity* should receive IG 0.5cc/kg IM (15cc max).

2) If an individual has received IVIG (400 mg/kg) ≤ 3 weeks *before* exposure, no additional IG is required. However, some experts recommend an additional dose of IVIG if ≥ 2 weeks have elapsed since last treatment. (Remember, when deciding to vaccinate these individuals, MMR vaccine should be given ≥ 2 weeks *before* any IG or other blood products.)

b. **Management of Contacts of HIV-Infected Individuals Who Are Themselves Exposed to Measles**

If they are susceptible and exposed < 3 days prior, they should receive MMR vaccine.
If they are susceptible and exposed 3–6 days prior, they should receive IG. Those receiving IG should subsequently be immunized with MMR after the appropriate interval. Please refer to the table in Attachment D: "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."

c. **General Guidelines for the Use of MMR Vaccine in HIV-infected and Potentially HIV-infected Individuals**

1) Prevaccination HIV testing is **NOT** recommended.

2) MMR vaccine is **recommended** for routine immunization of individuals with asymptomatic HIV infection who do not have evidence of severe immunosuppression.

3) MMR vaccine should be **considered** for all symptomatic HIV-infected persons who do not have evidence of severe immunosuppression, as defined in the table below.

4) It is now recommended that **severely immunocompromised HIV-infected individuals** (as defined by low CD4+ counts or low percent of CD4+ circulating lymphocytes—see table below) should **NOT** receive MMR or other measles-containing vaccines.

Measles-containing vaccines are *contraindicated* in those with the following:

Age Group	Total CD4+ Count	*or*	CD4+ as a % of Total Lymphocytes
< 12 mo.	< 750/mcL	*or*	< 15%
1-5 years	< 500/mcL	*or*	< 15%
6-12 years	< 200/mcL	*or*	< 15%
≥ 13 years	< 200/mcL	*or*	< 14%

5) It is now recommended that **severely immunocompromised HIV-infected individuals** (as defined by low CD4+ counts or low percent of CD4+ circulating lymphocytes—see above table) should **NOT** receive MMR or other measles-containing vaccines.

6) Since the immunologic response to vaccines is often poor in HIV-infected patients, the first dose of MMR should be given as early as possible after 12 months of age. This will increase the chance of an adequate immune response, before further deterioration of the immune system.

7) Give the second dose of MMR 4 weeks after the first. This will increase the likelihood of seroconversion.

8) During outbreak situations only, consider giving the first dose of **monovalent** measles vaccine at 6–11 months of age to those infants who are not severely immunocompromised. Remember, these children **must be revaccinated** with 2 doses of MMR beginning at 12 months of age. Mumps and rubella vaccines cannot be given at <12 months of age.

D. Preventive Measures

Personal Preventive Measures/Education

Vaccination, including routine childhood vaccination, catch-up vaccination of adolescents, and targeted vaccination of high-risk adult groups (including international travelers), is the best preventive measure against measles. It is particularly important to vaccinate susceptible household contacts of high-risk susceptibles who cannot themselves be vaccinated, such as immunocompromised individuals, pregnant women, and infants. Good personal hygiene (which consists of proper handwashing, disposal of used tissues, not sharing eating utensils, etc.) is also important in preventing measles.

Please refer to the most current versions of the ACIP statement on measles, rubella, and mumps (listed under References, below), MDPH's *Immunization Guidelines*, and MDPH's *Massachusetts Immunization Program-Supplied Vaccines and Patient Eligibility Criteria* for details about MMR vaccine, the recommended schedule, who should and shouldn't get the vaccine, and who is eligible to receive state-supplied vaccine. These as well as other relevant resources are available through the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. For more information regarding international travel and measles, contact the CDC's Traveler's Health Office at (877) 394-8747 or through the internet at <http://www.cdc.gov/travel>. A *Measles Public Health Fact Sheet* for the general public can be obtained from the Division of Epidemiology and Immunization or through the MDPH website at <http://www.state.ma.us/dph/>. Click on the "Publications" link and scroll down to the Fact Sheets section.

ADDITIONAL INFORMATION

The following is the formal CDC surveillance case definition for measles. It is provided for your information only—it is not necessary to use this information for reporting or investigating a case. (CDC case definitions are used by the state health department and CDC to maintain uniform standards for national reporting on a national basis.) For reporting a case to the MDPH, always use the criteria outlined in Section 2) A of this chapter.

Case definition for measles (as defined by CDC)
Clinical case definition

An illness characterized by all the following:

- a generalized rash lasting ≥3 days
- a temperature ≥101.0°F (38.3°C)
- cough, coryza, or conjunctivitis.

Laboratory criteria for diagnosis

- Positive serologic test for measles immunoglobulin M (IgM) antibody, or
- Significant rise in measles antibody level by any standard serologic assay, or
- Isolation of measles virus from a clinical specimen

Case classification

Suspected: any febrile illness accompanied by rash
Probable: a case that meets the clinical case definition, has noncontributory or no serologic or virologic testing, and is not epidemiologically linked to a laboratory-confirmed case
Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed case. A laboratory-confirmed case does not need to meet the clinical case definition.

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Attachment A: Specimen Collection for Diagnosis of Measles (3 pages including requisition form)
Attachment B: Recommendations for Measles Immunization (1 page)
Attachment C: MMR Vaccine Concerns (5 pages)
Attachment D: Use of Immune Globulin (IG) (3 pages including table)

Note: These attachments are separate PDF files. To access them, go back to the *Guide to Surveillance and Reporting* main page and click on the L–M drop down menu. Each attachment is listed under Measles.